TITLE

TRANSFER METHOD FOR SURFACE DECORATION

CROSS REFERENCE APPLICATIONS

This application is a non-provisional application claiming the benefits of provisional application no. _____filed February _____ 2003, from U.S. provisional patent application No. 15,252 filed January 30, 2003.

FIELD OF INVENTION

The present invention relates to transferring an image from a paper, such as a photograph, to a fabric such as a shirt by means of a composite adhesive hot melt having a rubber base.

BACKGROUND OF THE INVENTION

This invention was conceived with a view of providing an easy and reliable process for surface decoration by means of image transfer, as well as products therefore. Furthermore, the intention has been to provide a process and a product that may be used by small scale business entrepreneurs, particularly in developing countries, such as craft producers, designers, T-shirt manufacturers, decal manufacturers and manufacturers of art reproductions. The

aim has also been to make versions of the process and products available to consumers.

The processes and products of this invention are developments of the methods specified in U.S. Patent Nos. 3,334,012 and 3,607,525, for the purpose of transferring images. These developments are mainly related to the use of a hot melt transfer adhesive, having a rubber base.

The main experiments and findings reported below have been carried out with a transfer adhesive of this kind, produced in the U.S. by Fasson Roll®, known as S-246. In Mexico, where this adhesive is available from Avery Dennison de Mexico, it is known as Adhesive #071. Another adhesive of that kind is manufactured in Mexico by ESAMEX® known by its specification code S67PS70086LAZI. Both versions are available in rolls.

The appearance of the rolls and the adhesive and the use of the same are almost identical with the one of acrylic based pressure sensitive adhesives. Various adhesives may be utilized in the same or similar manner for the purpose of obtaining decals. However, here the similarity ends. The claimed hot melt type adhesives claimed have a quality that other adhesives lack, namely the ability to migrate through layers, when heated. The result can be an easy-to-use method to custom decorate a washable T-shirt.

There are at least two distinct manners to manufacture composite sheets. The first one is to have them made by a company having machines for coating. In this manner the coating will be tailor made for its purpose. However, this is a costly undertaking, and requires considerable economic resources. Furthermore, as the cost per unit is dependent on the quantity being manufactured, it would take quite some time to lower the costs sufficiently to be able to sell the sheets at a reasonable price. On the other hand, the S-246 transfer adhesive and equivalents are being produced in great quantities and, for this reason, are available at a low price. Therefore, this method invention has been devoted to using composite sheets made by lamination, using a hot melt adhesive with a rubber base, thus available as a transfer adhesive. As stated above, this adhesive may be obtained in rolls, making it possible to apply the adhesive on rolls of plastic films in a laminating machine. However, sheet lamination of composite sheets, using a heat transfer machine are also taught herein.

SUMMARY OF THE INVENTION

The primary aspect of the present invention is to provide a method using a composite sheet to transfer an image from a paper to cloth substrate, wherein the image migrates into the cloth.

Other aspects of this invention will appear from the following description and appended claims, reference being made to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

Before explaining the disclosed embodiment of the present invention in detail, it is to be understood that the invention is not limited in its application to the details of the particular arrangement shown, since the invention is capable of other embodiments. Also, the terminology used herein is for the purpose of description and not of limitation.

The below drawings are cross sections of successive stages of the transfer processes, showing the details of the elements being processed. Dimensions are not to scale, and the thickness of cross sections are greatly exaggerated. The adhesive of all adhesive layers shown in the figures is hot melt rubber based and adhesive, referred to as adhesive only.

FIG. 1 shows the cross section of a sheet of transfer adhesive.

FIG. 2 shows the cross section of a sheet of paper with an image on its surface.

FIG. 3 shows the cross section of a plastic film supported by a sheet of one-side-coated paper.

FIG. 4 shows the cross section of a plastic film supported by a silicone coated sheet.

FIG. 5 shows a cross section of a composite sheet of the preferred version, the plastic film of FIG. 3 supported by a one-side-coated paper, having been applied on the adhesive of FIG. 1.

FIG. 6 shows the cross section of the laminate of the composite sheet of FIG. 5, positioned with its adhesive layer in contact with the image of FIG. 2.

FIG. 7 shows the cross section of the laminate of FIG. 6, the image paper backing having been completely removed and the decal completed.

FIG. 8 shows the cross section of the decal of FIG. 7 being applied over a substrate.

FIG. 9 shows the cross section of the first face of the heat application of the decal of FIG. 8, the decal support sheet being removed.

FIG. 10 shows the cross section of the removal of the silicone coated ironing release paper of the decal of FIG. 9, at completion of the image transfer.

FIG. 11 shows the cross section of the decal of FIG. 7 with a layer of transfer adhesive applied over the decal (reverse) image.

FIG. 12 shows the cross section of the decal of FIG. 11 applied on a substrate.

FIG. 13 shows the cross section of a zinc oxide coated electrostatic copying paper.

FIG. 14 shows the cross section of a layer of white ink applied on the surface of a triple coated printing paper.

FIG. 15 shows the cross section of a "White Background Sheet".

FIG. 16 shows a cross section of an adhesive decal with a white background.

FIG. 17 shows a cross section of an adhesive decal with a white background applied over a substrate.

FIG. 18 shows a plane view of an ink jet print of an art reproduction printed in an ink jet printer on a white ink jet printing paper.

FIG. 19 shows a plane view of an ink jet print of the art reproduction shown in FIG. 19, printed in an ink jet

printer on a zinc oxide coated electrostatic copying paper.

FIG. 20 shows a plane view of an ink jet print of the art reproduction, shown in FIG. 19, printed in an ink jet printer on a zinc oxide coated electrostatic copying paper.

DETAILED DESCRIPTION OF THE DRAWINGS

Figure 1 (prior art) shows the cross section of a transfer adhesive (sheet 100) in accordance with this invention. The rubber based hot melt adhesive (1) (preferably S246) is located between the liner (2) with the silicone layer (3a) and the liner (4) with the silicone layer (3b). The force required to peel off release layer (2) is less than the one required to peel off liner (4). The most common use for this transfer adhesive is to paste a picture onto a substrate. When you peel off 2 or 3, the silicone layer 3a, 3b goes with the liner (usually paper). Thus, a two sided adhesive can attach a photo to a cardboard substrate.

Fig. 2 shows the cross section of an image (5) located on the surface of a paper (6), which may be a bond paper or a coated paper. The image may be derived by any known printing, copying or coloring method, except for methods using water soluble inks or coloring media, such as those used in ink jet printers. For transfer of ink jet prints in accordance with this invention, a zinc oxide coated electrostatic copying paper has to be used, as shown in Drawings 18 & 19.

Fig. 3 shows the cross section of a plastic film (8) supported by a one-sided coated paper (7), which has been heat laminated to the film with its non-coated side in contact with the same. The film (8) may also be coated, or extruded over said non-coated side. Good results have been obtained by roller application of a 46 percent acrylic emulsion manufactured by Rohm & Haas as emulsion "B60A". Successful tests have been made with polyethylene film extruded over a 75 g one-side-coated paper, to be used for other purposes. For transfer of images located on coated papers, needing little time of submersion, the preferred laminates have been obtained with a 75 g/m^2 one-side-coated paper, produced by Kimberly Clark of Mexico S.A. de C.V., known as Lustrolito™ , "una cara", laminated to various polyurethane films produced by Deerfield Urethane, Inc. This laminate is the preferred version of a composite sheet

for transfer of images located on coated papers. However, the support paper is only required for thin plastic films. Heavier films do not require a support sheet. On the other hand, for transfer of images located on tough paper qualities, such as recycled papers, a one-side-coated paper with a water resistant coating will be required. One paper of this kind is produced in Colombia and marketed in Mexico by Papel S.A. under the trademark of Propalcot.

Fig. 4 shows the cross section of a plastic film (8) supported by a silicone coated liner (2), to which it has been heat laminated with the silicone coating (3a) in contact with the plastic film. This laminate is the preferred one for the two-step application of a composite sheet over an image. It may also be used for composite sheets.

Fig. 5 shows the cross section of the preferred plastic film laminate of Fig. 3 positioned with the plastic film (8) in contact with the adhesive (1), stripped of the liner (2) ahead of the lamination. I have found that an extruded polyethylene film may be attached to the adhesive, without heat, while the polyurethane and acrylic films require low heat pressing. The three mentioned films are examples of films which have been thoroughly pressing. The three mentioned films are examples of films which have been thoroughly tested for transfers of images in accordance with

this invention. However, thermoplastic as well as thermosetting films to which the adhesive adheres, may also be used, e.g. mylar and vinyl films, both of which have been successfully tested for adhesion.

Fig. 6 shows the cross section of the laminate of Fig. 5 positioned with the adhesive (1), stripped of its second liner (4), in contact with the image (5), which is to be transferred by the present invention method. No heat and little pressure is needed. In respect of the latter, it is recommended that for the consumer version of a transfer kit, the laminate be rubbed over the support paper (7) with an applicator, such as a tongue depressor, prior to being submerged in water.

Fig. 7 shows the cross section of the completed decal, following removal of the image paper backing of the laminate shown in Fig. 6, preferably by soaking in water.

Fig. 8 shows the cross section of the decal of Fig. 7 applied over a substrate, such as a shirt to be decorated.

Fig. 9 shows the cross section of the decal of Fig. 7, applied over a substrate, having been pressed for 10 seconds, covered with a wet press cloth at polyester temperature (nominally about 120° C). The steam created by the pressing has caused the bond between the support paper (7) and the plastic film (8) to loosen and the heat has caused the adhesive (1a) to migrate through the image (5),

slightly into the surfaces of the substrate (9). By twisting the decal slightly, it will separate completely, and may now be peeled off, as indicated.

Fig. 10 shows the cross section of the completion of the transfer, commenced in Fig. 9. After removal of the composite sheet support paper, as shown in Fig. 9, the decal has been covered by a silicone coated release paper (10) and pressed for 40 seconds at the same polyester or slightly higher temperature. This has caused the adhesive (1b) to migrate further into the substrate, giving the transfer a firm hold. In such a manner, transfers to fabric become completely machine washable. When cool, the silicone coated ironing paper (10) is peeled off. The transfer has been completed, and the surface decorated accordingly.

Fig. 11 shows a cross section of an adhesive decal, obtained by covering the (reverse) image (5) of the decal shown in Fig. 7, with a layer of transfer adhesive (1), its second liner (4) still covering the adhesive surface.

Fig. 12 shows a cross section of the adhesive decal shown in Fig. 11, stripped of its liner and applied over a substrate (9). In accordance with this invention, the hot melt (S-246) adhesive (1) is to be used. As a result, the resultant transfer will be fully machine washable without having been heat pressed.

Fig. 13 shows the cross section of a zinc oxide coated electrostatic copying paper. The zinc oxide layer (12) is attached to the support paper (11), from which it may be released after a few minutes of soaking. The zinc oxide layer lends itself to printing in an ink jet printer, in particular for printing of patterns as well as for subsequent painting with color pencils, crayons or markers. Black inks should be used when the pattern is supposed to be visible. However, when it is to be invisible, it may be printed in other colors, as required. Decals derived from images printed on the zinc oxide layer (12) will have this layer as a background layer and may, for this reason, be applied on dark substrates.

Fig. 14 shows the cross section of a triple coated paper (15). A white color layer (13) has been printed on top of the triple coating layer (14). Mechanically, this laminate functions in the same manner as the one of Fig. 13, i.e. the support paper 15 will release after a few minutes of submersion. Decals derived from images printed on the white color layer (13) will have this layer as a background and may, for this reason, be applied on dark substrates.

Fig. 15 shows the cross section of a White Background Sheet (150). This sheet has been obtained by provision of layers of transfer adhesive (1a, 1b) on both sides of the zinc oxide coating (12), shown in Fig. 13, or the white

printing ink layer (13), shown in Fig. 14. This laminate has been obtained by first applying the transfer adhesive (1a) over the zinc oxide layer (12) or the white printing ink layer (13). The support paper (11) or (15), respectively, was, thereafter removed, exposing the respective layers' reverse side. This may be achieved by a few minutes of wetting of the support paper by steam or by a wet cloth or by submersion. After a period of drying, the transfer adhesive (1b) was applied on the white layer reverse side, and the laminate dried. This laminate may be used for the purpose of providing decals with a white background, as shown in Fig. 16.

Fig. 16 shows the cross section of an adhesive decal with a white background. The White Background Paper shown in Fig. 15 was stripped of the liner (4b) over the transfer adhesive layer (1b)and applied with the adhesive layer (1b) in contact with the decal (reverse) image (5). While the two liners over the layers of transfer adhesive originally had the same properties, the moistening of the laminate in order to remove the support paper has increased the force required to remove the liner (4a), which facilitates the removal of the liner (4b).

Fig. 17 shows the cross section of the adhesive decal with a white background applied over a substrate(9). The decal liner (4a) was the first removed, and the decal

applied with the adhesive (1a) in contact with the substrate (9). In accordance with this invention, preferably the hot melt (S-246) adhesive is to be used. This will make transfers machine washable without heat pressing.

Fig. 18 shows a plane view of a painted image, printed in an ink jet printer with water soluble inks, on a white ink jet paper.

Fig. 19 shows a plane view of the same painted image, printed in an ink jet printer with water soluble inks, on the zinc oxide coating of an electrostatic copying paper. As will be seen, the colors of this print are pale and weaker than those of Fig. 18. A transfer to canvas will have about the same colors. This may be utilized for painting of art reproductions, and for teaching. The image on the zinc oxide layer already has the color pattern, though pale and weak. In order to obtain a good reproduction, the colors have to be reinforced. The master painter knows how to do that, and the result of his efforts will become a true reproduction. The student will learn to paint, by reinforcing the colors in accordance with the instructions provided by the teacher.

Examples

Example 1. A color laser copy on a triple coated paper was to be transferred to canvas. The picture was cut out

with a slight margin and placed on the ironing paper, face up. A similar piece of a Composite Sheet was also cut cut. The liner was removed and the sheet positioned with the adhesive in contact with the image. The Transfer Paper printed support paper was then rubbed with a squeegee, after which the laminate was submerged. After a few minutes of soaking, the image paper backing was peeled off, and the reverse image trimmed. The decal had now been completed, ready for immediate application, or for application later on. The decal was positioned on the sheet of canvas, covered with a wet press cloth, and pressed for 10 seconds at "polyester" temperature. The press cloth was then removed, the resultant transfer twisted lightly and the decal support paper peeled off. The decal was, thereafter, covered with a silicone coated ironing paper and pressed for 40 seconds at the same temperature. When cool, the ironing paper was removed. The transfer had now been completed.

Example 2. A magazine picture was to be transferred to a T-shirt. The picture was cut out and placed on the Ironing Paper, face up. A similar piece of a Composite Sheet was also cut out. The liner was removed and the Composite Sheet positioned with the adhesive in contact with the image. In order to secure good contact, the laminate was then rubbed with a squeegee. It was thereafter submerged in water. After 1 hour of soaking, the laminate

was removed and placed on the working surface with the image paper backing up. The saturated paper backing was then peeled off and the reverse image completely cleaned. The laminate reverse image was, thereafter, trimmed. The decal had now been completed, ready for immediate application or application later on. The application was completed in exactly the same manner described above.

Example 3. A visitor of the Internet home site of an art supply manufacturer downloaded the pattern of an image and printed the same in an ink jet printer on the zinc oxide coated paper. A similar piece of a Composite Sheet was also cut out. The printed pattern was, thereafter, colored, using permanent markers for all but one of the colors, which was colored with crayons. The painting was placed on the Ironing Paper and the piece of the Composite Sheet applied over the same. The laminate was then submerged for 10 minutes, after which the zinc oxide layer support paper was peeled off and the image trimmed. The decal had now been completed, ready for immediate application or application later on. The application was made in the same manner as explained in Example 1.

Example 4. A decal manufacturer printed images to be applied on windows, on sheets of 75 g one-side coated paper. Composite Sheets of the corresponding size were cut out and applied over the images and the laminates dye cut, submerged

and recovered when the image paper backings had loosened and fallen off. The iron-on decals obtained were cleaned and dried, whereafter they were placed on sheets of bond paper, face up, and covered with ready cut pieces of S-246 transfer adhesive, which was pressed down over the exposed reverse images. The laminates were lifted up, excess adhesive remaining on the sheets of bond paper, and overlapping liners trimmed off. The resultant adhesive decals were stored in polyethylene bags, ready for application.

Example 5. A decal manufacturer printed images for adhesive application on dark substrates, on sheets of triple coated paper. Composite Sheets were cut out and applied over the images. The laminates were dye cut, submerged and recovered when the images paper backings had loosened and fallen off. The iron-on decals thus obtained were placed on a Teflon coated surface, face up, and covered with ready cut sheets of White Background Paper, pressed down over the exposed reverse images. The laminates were trimmed, and the completed decals placed in polyethylene bags, ready for application.

Although the present invention has been described with reference to preferred embodiments, numerous modifications and variations can be made and still the result will come within the scope of the invention. No limitation with respect to the specific embodiments disclosed herein is

intended or should be inferred. Each apparatus embodiment described herein has numerous equivalents.

DETAILED DESCRIPTION OF THE INVENTION

As noted above the best mode of the present invention uses the S-246 adhesive by Fasson®. It is a general purpose rubber based adhesive featuring high initial tack and ultimate adhesion. The adhesive data sheet follows below, wherein on skilled in the art can substitute other generic composite sheets to practice the present invention.

Fasson® S-246 is a general purpose rubber based adhesive featuring high initial tack and ultimate adhesion.

Type: Hot Melt Rubber

Substrate	Loop Tack	Peel Adhesion
Stainless Steel	6.2 lbs	3.0 lbs-tear
Treated HDPE	4.3 lbs	2.2 lbs-tear
Polypropylene	4.5 lbs	3.0 lbs-tear
Recycled Corrugated	2.0 lbs	0.8-1.4 lbs – Pulled Fiber
Glass	6.0 lbs	2.6 lbs-tear

Minimum Application Temperature: +40°F 4°C

Service Temperature Range: +65°F to +160°F

Face:	60# C1S Paper at room temperature on standard lab panels
FDA Compliance:	FDA Compliance: Title 21, Section 175.105 of the Code of Federal Regulations (21 CFR 175.105). Compliance to this regulation permits the use of this adhesive in applications for which the adhesive either (1) is separated from the food by a functional barrier, which will prevent the migration of any of the adhesive components to the food, or (2) has incidental contact with food limited to the trace amount at the seams or the edges of the label.

Product Data

S-246 ADHESIVE

S-246 is a general purpose rubber based adhesive featuring high initial tack and ultimate bond strength. Excellent on packaging films and plastic substrates.

General Adhesive Information

Type: Hot Melt Rubber

Adhesive Caliper: 0.0006 inches ± 10%

Minimum Application Temperature: +40°F

Service Temperature Range: -65°F to +160°F

FDA Compliance: S-246 is specified where compliance to FDA 175.105 is required. This section covers applications where incidental contact between adhesive and food may be possible – also referred to as "seam" contact. Consideration should also be given to the proper selection of facestock when dealing with FDA requirements.

Shelf Life: One year when stored at +72°F/50% R.11.

Application & Uses

S-246, with its high initial tack and excellent long-term bond strength, has a wide variety of uses. This adhesive will be used for shipping labels applied to corrugated or packaging films, and for product identification labels applied to a wide variety of substrates including glass, metal, plastic and others.

Typical Adhesion Values (lbs/inch)

SUBSTRATE	24 HR PEEL	LOOPTACK
Facestock:	**50# DSX**	**50# DSX**
Stainless Steel	3.0-Tear	5.5-6.8
Treated HDPE	2.2-Tear	3.7-4.9
Treated HDPE	1.9-2.5	3.8-4.5
Polypropylene	3.0-Tear	4.1-5.0
Recycled Corrug.	0.8*-1.4*	1.6-2.4*
Glass	2.6-Tear	4.9-7.1

*Pulled Fiber During Removal

As with all pressure-sensitive adhesives, S-246 should be tested thoroughly under end-use conditions to make sure it meets the requirements of the specific application.

The S-246 adhesive has a second liner that requires considerable force to peel off. For this reason, it becomes difficult to have some plastic films attached to a silicone coated release sheet, as the force required to release the same must be greater than the force required to release the S-246 adhesive second liner. Such sheets are not readily available in the market and have to be obtained by special order, which is a costly proposition. Therefore, various

other known release methods were tested, such as having the plastic film adhering to the support sheet by means of a removable adhesive. This works fairly well, provided the decal is not ironed-on at higher temperature than the one specified for nylon. Good results were obtained using Fasson UR1® ultra removable adhesive. However, if the user applies the decal at too high a temperature, the removable adhesive will turn into a permanent adhesive, making it impossible to remove the support sheet at the end of the transfer process.

For the above reason, a wet release of the support sheet, using a water soluble adhesive, was tried. It works satisfactorily, but the sheets become easily curved and wrinkled, due to humidity. The solution to use packages such as those being used for water release decals was found impractical. Finally what was to become the preferred mode, the non-coated side of a one-side coated paper, in accordance with U.S. Patent No. 5,032,449 - DECALS AND PROCESSES FOR TRANSFER OF IMAGES TO SUBSTRATES, was tested. As will be seen below, the layers of coating and the weight

of the paper will affect the time and quality of the release.

Various qualities and gram weights of the paper having the original image were tested, such as the Kimberly Clark de Mexico® Lustrolito 1 c 75 g/sqm and 100 g/sqm. When heat laminated to a polyurethane film and submerged, these paper qualities release rapidly. The 75 g version will separate by itself and fall off the laminate after about 15 minutes of submersion. On the other hand, a 100g one-side coated paper of Colombian origin with the trademark of Propalcot, also laminated to a polyurethane film, will adhere to the submerged laminate for several hours.

Notwithstanding, if pressed for 10 seconds with a wet cloth, it may be peeled off from the transferred image in one piece. In addition, the release qualities of these papers were tried on laminates with acrylic and polyethylene films. These laminates were obtained, as follows:

a) Acrylic film: by applying acrylic emulsion with brush or roller over the paper non-coated side.

b) Polyethylene film: by lamination of the film to the paper non-coated side by extrusion.

These laminations work well. For a consumer version of the composite sheet, intended for transfer of magazine pictures, the Propalcot® 100 g/sqm one-side coated paper, laminated to a 1 mil polyurethane film of a kind available from Deerfield Urethane®, South Deerfield, MA, has proved to function very well. Such a composite sheet is made as follows:

a) The paper is positioned with its non-coated side in contact with the polyurethane film, heat and pressure is applied over the paper-coated side, by pressing for 15 sec. at about 140°C.

b) A layer of the S-246 transfer adhesive is applied over the polyurethane film and pressed for 15 seconds at about 140°C.

c) The sheets are trimmed to desired size.

A composite sheet of this kind is used as follows:

a) Cut out the picture, leaving a slight margin all around. Also, cut out a similar piece of the composite sheet.

b) Peel off the liner of the piece of the composite sheet, and position the piece with the adhesive in contact with the image.

c) Submerge the laminate until the picture paper backing becomes saturated. A couple of minutes for coated papers and several hours for pictures on recycled paper.

d) Remove the picture paper backing. May be peeled off in large pieces from coated papers, and worked off from difficult paper qualities, such as recycled paper.

e) Trim the "Iron-on" decal, which is now completed.

The decal may be applied immediately, or later on. In order to protect clear areas from getting tacky due to migration of the adhesive, the image surface should be rubbed with talcum powder and the decals placed in polyethylene bags.

Application of decals on substrates that may be ironed, is made as follows:

a) Position the decal with the image in contact with the desired surface. Cover with a wet press cloth

and press for 10 seconds with the iron preheated to "polyester" temperature. If it is a stored decal, it should first be submerged for a couple of minutes.

b) Twist the decal and peel off the support paper. (The relatively low heat and short time will have caused the adhesive layer to expand and migrate slightly through the image layer of printing inks or copy toners, through the talcum powder layer, if any, into the substrate, giving the same a slight hold to the substrate.

c) Cover the image with a silicone coated ironing paper and press for 30-40 seconds. Let cool. When cool, remove the ironing paper. The transfer has been completed.

The second pressing will cause the adhesive to migrate further into the substrate, giving the transfer a firm hold that will withstand multiple machine washings. It is, of course, possible to press the decal for 40 seconds and remove the paper thereafter by pressing with a wet press

cloth. However, this is not recommended, as prolonged pressing over the support paper may cause some of the coating pigments to transfer, causing whitish spots on the transfer surface.

A dry release decal may be produced in the same manner as this version, using a silicone coated paper for support instead of the one-side-coated paper. As stated above, the force required to peel off the silicone coated paper must be greater than the one needed to peel off the composite sheet adhesive liner. This kind needs only to be pressed for 30 seconds at a slightly higher temperature. After a couple of seconds of cooling, the silicone coated support paper may be peeled off. The transfer is then completed. This version is more costly to produce, as the required release paper is not available in the market and has to be produced for this purpose. Furthermore, this release paper must be waterproof in order to make the submersion of the laminate possible.

While a silicone or other dry release system is difficult to include in a composite sheet, it is well suited for the divided process. The decal is prepared in exactly the same manner as described in U.S. Patent No. 3,607,525,

incorporated herein by reference. The application is the same as the one described above.

Application with adhesive does not involve anything new. The decal may simply be pasted to the substrate using adhesive, paint or varnish. A decal of this kind should have the 75 or 100 g Lustrolito® support paper, which is easy to remove by application of a piece of wet cloth over its surface. It should only be used for "easy to transfer" pictures, such as most pictures located on clay coated paper. While it is always better to wait until the adhesive has dried before removing the support sheet, I have found that in most cases, as soon as the adhesive has taken hold, the support paper may be removed. In addition to using this mode for applications on surfaces which are difficult to iron, water soluble school adhesives may also be used on surfaces suitable for heat application, e.g. by children too young to use an iron. An adult may thereafter press the transfer, which will then appear heavy and non-flexible. However, during the first washing the adhesive will dissolve and disappear, and the transfer will then look like any other transfer, though perhaps with a couple of wrinkles,

which disappear with pressing. The fact that the transfer does not loosen is another proof of the fact that the adhesive even migrates through a layer of another adhesive.

A full-fledged adhesive sticker may be obtained by application of transfer adhesive over the decal image. The decal is produced in the following manner:

a) Select a composite sheet with a 75 g or 100g Lustrolito® one-side-coated paper as a support paper.

b) Prepare a decal in the manner described above. If the paper is difficult to remove and has to be submerged for a longer period than 10-15 minutes, submerge it with the support paper resting on a piece of bond paper. This will prevent the support paper from falling from the laminate, even if in a stage of release.

c) Place the decal on a release paper with the image in contact with the same. Cover with an ironing paper and press for 15-20 seconds with the iron preheated to polyester temperature. The pressing will cause the support paper to re-adhere to the plastic film.

d) Place the decal on a sheet of bond paper, image up. Apply a piece of transfer adhesive, slightly larger than the image, over the same. In order for the adhesive to stick well, 10-15 seconds of pressing over its liner is recommended.

e) Trim the liner. The adhesive decal is now completed.

This decal is simple to apply. The liner is removed and the decal positioned with the adhesive image in contact with the substrate. The support paper is next moistened and peeled off. The transfer is completed. In the event that S-246 adhesive is being used, the transfer will become machine washable without pressing. This is unique. To my knowledge, there is presently no process available in the market with which an image may be transferred and the transfer will become machine washable, without having been heat pressed.

The decal may also be converted into a removable sticker with modest adhesive strength, adequate for temporary applications. This is done in the following

manner: The decal is positioned on a silicone coated release paper with the (reverse) image in contact with the release surface. The decal is, thereafter, pressed for 30-60 seconds, with the iron at "nylon" temperature, keeping the iron and sandwich completely still. Any movement would damage the image. After a period of cooling, the sticker is ready for application, the adhesive having expanded and migrated through the image layer, which has become sticky. When the sticker is to be applied, the liner, i.e. the silicone coated paper protecting the adhesive image, is peeled off and the sticker positioned on the desired substrate, to which it will adhere by its adhesive layer. The decal support paper is, thereafter, removed.

The above processes may be used for printed, copied, hand drawn and hand colored images, except prints in ink jet printers with water soluble ink. While I have not yet designed a special paper for this purpose, I have discovered that ink jet prints which have been printed on zinc oxide coated electrostatic copying paper may be transferred, though only prints in black and dark colors transfer well. Light colors, reds and yellows in particular, will appear

pale and weak on the paper as well as on the transfers. For this reason, the main use of such prints is for transfer of patterns and outlines, to be colored. Such coloring may be made before the transfer, using color pencils, crayons and markers, or after completion of the transfer, using permanent markers, oils and acrylics. The transfers are fully machine washable. Furthermore, as will be dealt with in connection with transfers to dark backgrounds, the zinc oxide coating may also be utilized for the purpose of providing decal images with a white background.

The composite sheet is, without doubt, the most important part of this invention. With it, it is possible to transfer practically any image located on paper. Thus, a person may be able to decorate his or her personal belongings with images found in magazines, newspapers and postcards as well as pictures that he or she has painted themselves, using the composite sheet and the transfer process in accordance with this invention. Sometimes such transfers may become cumbersome and time consuming. This is the case when the image paper backing consists of recycled paper and, for this reason, is difficult to remove. For an

amateur, this does not matter very much. Just let the laminate soak until the paper is completely saturated. However, for commercial applications, the process must be as simple as possible, as economic as possible and as fast as possible.

The composite sheet and the process for its use satisfy well the first two of these requirements. For the third requirement, speed of decoration, the speed and method of obtaining the image on the paper, as well as the speed of the transfer process proper, which is directly related to the quality of the paper, are the dominating factors. Offset printing or digital printing is the fastest method, when quantity is involved. However, for artisans, use of a computer printer is also adequate, as is photocopying. Some artisans may wish to print the patterns, and paint them by hand, either before or after the transfer to the item to be decorated. As to the speed of the transfer, the paper quality is the most important factor and, for this reason, an important part of this invention.

For transfers to transparent substrates, where the transferred image is to appear equally transparent, the

image to be transferred should be printed or copied on the non-coated side of a one-side-coated paper. Practically any kind of such a paper may be used. The "Lustrolito 1 c", 75g, 90g & 100g, papers, produced by Kimberly Clark de Mexico, have been successfully tested, as has a Colombian paper with the trademark of Propalcot. For transfers to light and semi-dark substrates, the new kind of coated papers with triple layers of coating, function very well. The semi-matte qualities of such a paper, in Mexico known as "Super Polart Triple recubrimiento", produced by the Belgian company Burgo Ardennes has proved to provide excellent and rapid transfer of printed, copied and hand painted images. The white pigment of the coating provides the decal image with a semi-white layer, which makes possible applications to semi-dark surfaces.

The laminates of composite sheets and these papers, whether one-side coated or with triple coating, do only have to be submerged for a couple of minutes before the paper backing may be peeled off from the reverse image. After 20 minutes of submersion, the image paper backing will separate by itself and fall off, automatically turning the laminate

into a decal. For commercial utilization of this invention, the image may be printed at high speed on the Polart Paper or on the one-side-coated paper, and the composite sheet successively applied with its adhesive side in contact with the printed images. The resultant laminate is, thereafter, dye cut and submerged. For a simple automatic process, the composite sheet as well as the paper should be in roll form. With such a process, several hundreds, even thousands of laminates may be produced per hour, depending on the size of the laminates. Thus, if 100 or 1000 dye cut laminates are submerged, after 20 minutes and light rinsing, the 100 or 1000 laminates have been converted into decals, ready for instant application or application at a later period. In this manner, decals may be produced as a speed that is competitive with decals produced in laser photocopies. Instead of submersion in water, the image paper backing may be treated with steam, after which it may be peeled off. For this purpose, the laminate is placed on the working bench, image paper backing up, and covered with a wet press cloth. By pressing over the wet cloth for 10 seconds, with the iron at polyester temperature, the paper backing

releases from the image and may be peeled off. This works well, and a machine may be developed for this purpose. Until then, the optimum method for mass production of decals, in accordance with this invention, is to submerge the laminates, as mentioned above.

Of the decals mentioned above, only those derived from a picture located on a zinc oxide coated electrostatic copying paper may be applied on dark substrates. This becomes possible because the zinc oxide coating gives the decal a white background, which is necessary in order for the transferred picture to become visible on a dark substrate. In addition to printing on this paper in an ink jet printer, with waterproof inks, offset printing may be used. Instead of utilizing a white zinc oxide coated paper, a one-side-coated paper, or a Polart paper may be given a white color layer, and images printed on the white color layer may also be applied on dark substrates, in the same manner as images printed on the zinc oxide coated paper. The resultant decals, whether having a white layer of zinc oxide or layers of white offset ink, need an additional

white layer for application on really dark substrates, such as black T-shirts, as will be explained below.

Decals with images obtained on a zinc oxide coating or printed white layer, ought to have a heavier layer of adhesive than other decals. For application of such decals, the adhesive has to migrate through a color layer, i.e. a longer distance than for any of the other above-mentioned transfers. I have found that the standard layer of adhesive of the two transfer adhesives tested, having a thickness of about 1 mil, is satisfactory for transfers of prints and copies on papers other than zinc oxide coated paper or offset coated papers, which require two layers. Two layers are also recommended for transfer of newspaper pictures.

A transfer of an ink jet print on zinc oxide coated paper is made in almost the same manner as prints on other papers. A composite sheet with a double layer of adhesive is applied over the print. The sandwich is submerged for 5-10 minutes. The laminate is then placed on the working surface with the support paper down and zinc oxide coated backing paper up. If the ink is water soluble, the surface of the backing paper is then rubbed in order to prevent, as

far as possible, that colors bleed and be absorbed by it. This paper is, thereafter, penetrated with a fingernail and peeled off. Finally, the decal is trimmed. It is then completed. The decal is applied in the same manner as other decals.

Water soluble ink jet color prints on the zinc oxide paper and transfers of the same appear pale and weak, especially reds and yellows. This may be utilized by painters for the purpose of making art reproductions. The various colors are still sufficiently visible to make it possible for somebody skilled in the art of painting and mixing oils or acrylics to be able to reinforce them, guided by a color print of the same picture on ink jet paper. The result may become a true reproduction of the original painting. This method may be also be used for teaching purposes and by amateur painters, in a manner similar to painting by numbers. While the paint by number system utilizes numbered patterns printed on canvas or other substrates, this system utilizes colored patterns.

Application of decals on dark substrates is an important aspect of surface decoration and thus of this

invention. As said above, one method is to print the image on the white layer of zinc oxide layer or on a paper with a printed white layer. For transfer of prints and copies which are not located on a white color layer, one known method, utilized in the above-mentioned Lift-a-Picture kits, is to apply the decals by use of a white transfer adhesive. Unfortunately, white transfer adhesive is not generally available in the market and has to be specially ordered from one of the adhesive manufacturers, a costly proposition. A method specifically developed for this invention is to provide a "White Background Paper". The first step of the manufacture of such a paper is to apply transfer adhesive over the zinc coating of an electrostatic copying paper, or over the white offset printing of a one-side coated paper or a triple coated paper, such as the Polart paper. The next step is to submerge the laminate and, when saturated, remove the paper backing of respective white layers. The decal may then be applied on the white surface by heat pressing. The resultant adhesive decal is then applied in the manner described above, i.e. by removing the second liner of the transfer adhesive, pressing down the decal in the desired

position and, finally, wetting and removing the decal support paper.

Use of a White Background Paper of the above kind works, but the heat application of the decal on its surface tends to darken the white color of a zinc oxide layer as well as of the white offset layers. For this reason, a white screen printed layer is required. As such a layer becomes heavy, a better solution is to apply a second layer of transfer adhesive over the white layer. Such a White Color Paper with two layers of adhesive, one below and one above the white color layer, is considered to be the best mode of decoration of dark substrates. The paper is used as follows: The liner of the layer of transfer adhesive last applied is removed and the White Background Paper applied over the decal image. After trimming of the edges, the liner of the second transfer adhesive is removed and the decal pressed down in the desired position. Finally, the decal support paper is moistened and removed. If the S-246 adhesive has been used, the transfer, if applied on fabric, will become machine washable. There is no need for heat pressing, however, any wrinkles that may develop may be

leveled out by heat pressing at rayon or silk temperature. Higher temperatures may cause some of the darker colors to migrate and give the image darker tone. There are many adhesive decals or "stickers" available in the market. However, none of them can be applied on light as well as dark fabrics without heat pressing and still become machine washable. For this reason, decals for surface decoration in accordance with this invention are unique.

DISCUSSION OF DEVELOPMENTAL PROCESS

Below follows a summary of the above-noted invention.

1. A process for decoration of surfaces through transfer of indicia or images from paper to said surfaces by means of composite sheets derived from rubber based hot melt transfer adhesive, the process comprising the steps of:

a) combining a releasable support sheet with a plastic sheet;

b) stripping said transfer adhesive of its primary liner and placing the combined sheet obtained in step a) with its plastic surface in contact with the tacky adhesive surface.

c) stripping said transfer adhesive of its second liner and positioning the composite sheet obtained in step b) with its tacky side in contact with the indicia or image bearing layer of said paper.

d) obtaining an *"iron on decal"* by washing said indicia or image-including composite sheet in water to soften the paper and removing the same, thereby exposing the image or indicia retained in the composite sheet.

e) applying the decal obtained in step d) by positioning the same with the image or indicia in contact with said surface.

f) applying heat over the releasable support sheet, thereby causing said adhesive to expand and migrate through the layer forming the image or indicia, into said substrate.

g) stripping the decal of said releasable support sheet.

2. A process for decoration of surfaces through transfer of indicia or images from paper to said surfaces by means of

composite sheets derived from rubber based hot melt transfer adhesive, which includes:

a) stripping said transfer adhesive of its primary liner and positioning it with its tacky surface in contact with the indicia or image bearing layer of said paper;

b) combining a releasable support sheet with a plastic sheet;

c) stripping said adhesive of its secondary liner and placing the combined sheet obtained in step b) with its plastic surface in contact with the tacky surface of said paper.

d) obtaining an *"iron on decal"* by washing said indicia or image-including composite sheet in water to soften the paper and removing the same, thereby exposing the image or indicia retained in the composite sheet.

e) applying the decal obtained in step d) by positioning the same with the image or indicia in contact with said surface.

f) applying heat over the releasable support sheet, thereby causing said adhesive to expand and migrate through the layer forming the image or indicia, into said substrate.

g) stripping the decal of said releasable support sheet.

3. A process for decoration of surfaces through transfer of indicia or images from paper to said surfaces by means of composite sheets derived from rubber based hot melt transfer adhesive, which includes:

a) combining a releasable support sheet with a plastic sheet;

b) stripping said transfer adhesive of its primary liner and placing the combined sheet obtained in step a) with its plastic surface in contact with the tacky adhesive surface.

c) stripping said transfer adhesive of its second liner and positioning the composite sheet obtained in step b) with its tacky side in contact with the indicia or image bearing layer of said paper.

d) obtaining an "*iron on decal*" by washing said indicia or image-including composite sheet in water to soften the paper and removing the same, thereby exposing the image or indicia retained in the composite sheet.

e) converting the iron-on decal obtained in step d) into an "adhesive decal" by stripping a second piece of said transfer adhesive of its primary liner and positioning the decal obtained in step d) with its indicia or image surface in contact with said transfer adhesive exposed tacky surface.

f) stripping the adhesive decal obtained in step e) of its liner and positioning the same with the exposed adhesive in contact with said surface.

g) stripping the decal of said releasable support sheet.

4. A process for decoration of surfaces through transfer of indicia or images from paper to said surfaces by means of composite sheets derived from rubber based hot melt transfer adhesive, which includes:

a) stripping said transfer adhesive of its primary liner and positioning it with its tacky surface in contact with the indicia or image bearing layer of said paper;

b) combining a releasable support sheet with a plastic sheet;

c) stripping said adhesive of its secondary liner and placing the combined sheet obtained in step b) with its plastic surface in contact with the tacky surface of said paper.

d) obtaining an "*iron-on decal*" by washing said indicia or image-including composite sheet in water to soften the paper and removing the same, thereby exposing the image or indicia retained in the composite sheet.

e) converting the iron-on decal obtained in step d) into an "adhesive decal" by stripping a second piece of said transfer adhesive of its primary liner and positioning the decal obtained in step d) with its indicia or image in contact with said transfer adhesive exposed tacky surface.

f) stripping the adhesive decal obtained in step e) of its liner and positioning the same with the exposed adhesive in contact with said surface.

g) stripping the decal of said releasable support sheet.

5. A process for decoration of surfaces through transfer of indicia or images from paper to said surfaces by means of composite sheets derived from rubber based hot melt transfer adhesive, which includes:

a) combining a releasable support sheet with a plastic sheet;

b) stripping said transfer adhesive of its primary liner and placing the combined sheet obtained in step a) with its plastic surface in contact with the tacky adhesive surface.

c) stripping said transfer adhesive of its second liner and positioning the composite sheet obtained in step b) with its tacky side in contact with the indicia or image bearing layer of said paper.

d) obtaining an iron-on decal by washing said indicia or image-including composite sheet in water to

soften the paper and removing the same, thereby exposing the image or indicia retained in the composite sheet.

e) applying an adhesive layer over said indicia or image and/or over said surface.

f) positioning said decal with the indicia or image in contact with said surface.

g) stripping the decal of said releasable support sheet.

6. A process for decoration of surfaces through transfer of indicia or images from paper to said surfaces by means of composite sheets derived from rubber based hot melt transfer adhesive, which includes:

a) stripping said transfer adhesive of its primary liner and positioning it with its tacky surface in contact with the indicia or image bearing layer of said paper.

b) combining a releasable support sheet with a plastic sheet.

c) stripping said adhesive of its secondary liner and placing the combined sheet obtained in step b)

with its plastic surface in contact with the tacky surface of said paper.

d) obtaining an *"iron-on decal"* by washing said indicia or image-including composite sheet in water to soften the paper and removing the same, thereby exposing the image or indicia retained in the composite sheet.

e) applying an adhesive layer over said indicia or image and/or over said surface.

f) positioning said decal with the indicia or image in contact with said surface.

g) stripping the decal of said releasable support sheet.

7. A process for decoration of dark surfaces through transfer of indicia or images from paper to said surfaces by means of composite sheets derived from rubber based hot melt transfer adhesive, which includes

a) applying a white color layer by printing or coating or other known means over the surface of a triple coated paper.

b) stripping said transfer adhesive of its primary liner and positioning it with its tacky surface in contact with said triple coated paper's white surface, obtained in step a).

c) washing said white layer-including composite in water to soften the paper and removing the same, thereby exposing the white layer retained in the composite sheet.

d) obtaining a "white color transfer sheet" by stripping a second piece of said transfer adhesive of its primary liner and positioning the composite sheet obtained in step c) with its white surface in contact with said second piece of transfer adhesive exposed tacky surface.

e) obtaining a "white background adhesive decal" by stripping said "white color transfer sheet" of the secondary liner of said second piece of transfer adhesive and positioning any of the iron-on decals obtained in steps d) of numbers 1-6 with its indicia or image in contact with said "white color transfer sheet" exposed tacky surface.

f) stripping the white background adhesive decal of its liner and positioning it with the exposed tacky surface in contact with said dark surface.

g) stripping the decal of said releasable support sheet.

8. A process for decoration of dark surfaces through transfer of indicia or images from paper to said surfaces by means of composite sheets derived from rubber based hot melt transfer adhesive, which includes

a) stripping said transfer adhesive of its primary liner and positioning it with its tacky surface in contact with the white zinc oxide surface of an electrostatic copying paper.

b) washing the white layer-including composite sheet obtained in step a) in water to soften the paper and removing the same, thereby exposing the white layer retained in the composite sheet.

c) obtaining a "white color transfer sheet" by stripping a second piece of said transfer adhesive of its primary liner and positioning the composite sheet obtained in step b) with its white surface

in contact with said second piece of transfer adhesive exposed tacky surface.

d) obtaining a "white background adhesive decal" by stripping said "white color transfer sheet" of the secondary liner of said second piece of transfer adhesive and positioning any of the iron-on decals obtained in steps d) of numbers 1-6 with its indicia or image in contact with said "white color transfer sheet" exposed tacky surface.

e) stripping the white background adhesive decal of its liner and positioning it with the exposed tacky surface in contact with said dark surface.

f) stripping the decal of said releasable support sheet.

9) A process for decoration of surfaces with hand painted art reproductions through transfer of copies of paintings from paper to said surfaces by means of composite sheets derived from rubber based hot melt transfer adhesive, which includes

a) obtaining a computer image of said copy of a painting.

b) obtaining an ink jet print of said computer image on the zinc oxide surface of an electrostatic copying paper.

c) obtaining a print of said copy of a painting on an ink jet paper, or through other means

d) obtaining a weak image, though true in color, by transferring said ink jet print to said surface, utilizing any of the processes defined in numbers 1-8.

e) with the true copy as a guide, reinforcing the colors of said weak image through painting with oils, acrylics or art markers.

10. Processes in accordance with numbers 1-8 wherein said plastic sheet is formed of a thermoplastic resin.

11. Processes in accordance with numbers 1-8 wherein said plastic sheet is self supported.

12. Processes in accordance with numbers 1-8 wherein said plastic sheet is self supported.

13. Processes in accordance with numbers 1-8 wherein said releasable support sheet is a one-side coated paper.

14. Processes in accordance with numbers 1-8 wherein the releasable support sheet is a silicone coated paper.

15. Processes in accordance with numbers 1-8 wherein the releasable support sheet is a sheet of polyethylene.

16. Processes in accordance with numbers 1-8 wherein the releasable support sheet is paper coated with a removable or dissolvable adhesive.

17. Processes in accordance with numbers 1-8 wherein said paper consists of a triple coated paper.

18. Processes in accordance with numbers 1-8 wherein said paper consists of a zinc oxide coated electrostatic copying paper.

19. Processes in accordance with numbers 1-8 wherein a white color layer has been applied on the surface of said paper in order to serve as background of said indicia or image.

5

20. Processes in accordance with numbers 1-8 wherein said paper consists of photo quality in jet printing paper.

Although the present invention has been described with reference to preferred embodiments, numerous modifications and variations can be made and still the result will come within the scope of the invention. No limitation with respect to the specific embodiments disclosed herein is intended or should be inferred. Each apparatus embodiment described herein has numerous equivalents.